reversed with naloxone hydrochloride. The use of neuromuscular blocking agents should be avoided in patients who are spontaneously breathing but who might be particularly difficult to either intubate or ventilate after paralysis, such as patients with severe asthma, facial or laryngeal trauma, or supraglottitis. When the above-described cautions and contraindications are observed, neuromuscular blocking agents provide a highly useful and sometimes necessary role in aiding acute airway management.

EDWARD A. PANACEK, MD
Cleveland, Ohio

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Transvaginal Imaging of Ectopic Pregnancy

ADVANCES IN TRANSDUCER TECHNOLOGY have now produced transvaginal ultrasound imaging. A transvaginal probe is inserted into the vagina, providing an "unobstructed" view of the pelvic organs. The higher resolution transducers produce images of remarkable clarity, and the accuracy for defining an ectopic pregnancy is greater than with the transabdominal technique. Whereas previous reports have suggested a sensitivity on the order of 70% to 80% with transabdominal study, the sensitivity of the transvaginal technique is 95% to 100%.

The diagnosis of an ectopic pregnancy is virtually eliminated by defining an early intrauterine gestation. When the pregnancy is intrauterine, a 4½- to 5-week gestation may be diagnosed with relative certainty with transvaginal imaging. Similarly, the transvaginal ultrasonographic evaluation can define a living ectopic pregnancy at an early gestational age. Transvaginal imaging may show blood or solid irregular material, possibly a hematoma.

With the improved resolution offered by the transvaginal technique, the percentage of unruptured ectopic pregnancies discovered should increase. By adding color Doppler evaluation, the increased blood flow associated with ectopic pregnancies can be seen. In addition, identifying a "corpus luteum" by Doppler findings will also help locate the site of a pregnancy. These techniques should lead to early therapy and the sparing of Fallopian tubes.

There are many pitfalls in ultrasound imaging. The technique can be difficult, especially for the transvaginal examination. An ectopic pregnancy may, in fact, be out of the field of the transvaginal image so that a full transabdominal study would be required.

In summary, the transvaginal pelvic examination aids in the ability to diagnose ectopic or early intrauterine pregnancy or to suggest the absence of disease. Care must be taken not to overshadow clinical considerations. On the horizon are improved resolution and color Doppler capabilities. Transvaginal ultrasonography should be used routinely.

MICHAEL CRADE, MD
Long Beach, California

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Rectal Diazepam Therapy for Prehospital Pediatric Status Epilepticus

SEIZURES ARE A COMMON pediatric prehospital emergency. Of 889 consecutive patients younger than 18 years requiring prehospital advanced life support and monitored by the San Francisco General Hospital Medical Center over a 12-month period, 1989 to 1990, seizures constituted 34% of medical complaints. Other epidemiologic data on prehospital pediatric care have similarly shown that seizures are the commonest childhood condition confronting emergency medical technicians. Most convulsive episodes in children, however, are brief and do not require treatment. A small number progress to status epilepticus, defined by continuous or repeated convulsions without an intervening return of consciousness for at least 15 minutes. These patients often present vexing field management problems, especially because of difficulties in establishing vascular access and the high incidence of respiratory depression due to rapid intravenous diazepam administration.

Recent studies have shown a varying correlation between the duration of status epilepticus and neurologic outcome. Morbidity appears to be most correlated with cause, even for status epilepticus lasting more than an hour, except in very young patients with severe underlying disease, such as meningitis, prolonged submersion, or hypoglycemia. Therefore, a safe, slow-acting, first-line anticonvulsant agent with a high therapeutic ratio is needed. One such agent is rectal diazepam, which has been used safely and effectively in the home and hospital but has not been widely used in the field.

The preferred agent is undiluted intravenous diazepam solution. The drug is lipid soluble and is promptly absorbed from the highly vascularized rectal mucosa through the superior, middle, and inferior hemorrhoidal veins. Therapeutic serum concentrations are present in 5 to 10 minutes. The time to peak concentration varies, ranging from 5 to 60 minutes, but typically serum drug peaks occur in 10 to 20 minutes after rectal administration.

Rectal diazepam therapy will obliterate status epilepticus in more than 80% of cases. Seizures longer than 15 minutes may be less amenable to treatment by this method. The only study of prehospital rectal diazepam use for pediatric status epilepticus confirmed a high rate of efficacy (82%), using 0.3 to 0.5 mg per kg of parenteral diazepam solution per high rectal tube, in 11 children. Two patients who did not respond to rectal diazepam required extensive emergency department treatment, including the use of multiple anticonvulsants and endotracheal intubation. Both had encephalitis. No treated patient whose seizures stopped had a serious complication. Other studies of rectal diazepam use have shown an incidence of systemic complications of less than 1%. The most common complication is respiratory depression. Emergency medical technicians using parenteral or rectal diazepam in the field must be capable of providing airway and breathing support.

The method of rectal diazepam administration is simple. First, calculate the dose of diazepam (0.3 to 0.5 mg per kg) based on estimated body weight (maximum dose 10 mg). Draw the intravenous diazepam solution into a disposable tuberculin syringe and discard needle. Alternatively, draw the diazepam into a 3-ml syringe with attached blunt-tipped #5 French pediatric feeding tube. Next, insert the lubricated tuberculin syringe or flexible feeding tube 5 cm into the

rectum and inject the solution. Clear the tubing with 1 ml of air. Tape buttocks closed. Repeat dose in five minutes if the seizure continues.

The rectal route eliminates the need for intravascular access. This is particularly advantageous in children with status epilepticus, where immediate venous access is difficult.

RONALD A. DIECKMANN, MD
San Francisco, California

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Bacterial Meningitis in Emergency Departments

DESPITE OUR GROWING UNDERSTANDING of the pathogenesis of bacterial meningitis and an enlarged spectrum of antibacteriologic agents, bacterial meningitis remains an important cause of morbidity and mortality in the United States. More than 80% of cases of bacterial meningitis are caused by one of three organisms, *Hemophilus influenzae* (45%), *Neisseria meningitidis* (25%), and *Streptococcus pneumoniae* (10%), with United States mortality rates from 1978 to 1981 of 6.0%, 10.3%, and 26.3%, respectively.

Bacterial meningitis is a medical emergency, and a delay in administering antibiotics may be harmful. Unfortunately, there are frequent delays in therapy. Recently 122 cases were reviewed, and a median time delay in administering antibiotics of 3.0 hours was found, in contrast to the accepted "gold standard" of less than 30 minutes. Of note, 90% of the total time to antibiotic administration occurred after the initial physician encounter, often as a result of awaiting computed tomography or laboratory results. This delay is largely avoidable, and a review has been published addressing early antibiotic therapy and the issue of jeopardizing the diagnosis based on cerebrospinal fluid findings. Several studies have assessed interval cerebrospinal fluid analysis during intravenous antibiotic therapy. All, however, address intervals of 24 to 48 hours and not the 2 to 3 hours that might be expected in an emergency department. Although culture results might be affected by antibiotic administration in the emergency department, cerebrospinal fluid leukocyte counts and glucose and protein values are much less affected. Thus, the diagnosis of meningitis would not be obscured by an early initial dose of the appropriate antibiotic, and common sense suggests that the sooner the antibiotics are given, the better the outcome for the patient.

Mediators of inflammation, specifically interleukin-1 and tumor necrosis factor, have been recently implicated in the pathophysiology of bacterial meningitis. After colonizing the nasopharynx, the invading agent gains access first to systemic circulation and then to the cerebrospinal fluid, probably through the choroid plexus, producing subarachnoid space inflammation and local vasculitis. Cerebral vasospasm or cortical thrombophlebitis may explain the seizures or focal neurologic deficits often seen with bacterial meningitis. Efforts to modify this process using anti-inflammatory agents have shown promise. A double-blind placebo-controlled study of the use of dexamethasone (0.15 mg per kg every six hours for four days) was done on 200 infants and children, and a statistically significant decrease was found in the incidence of hearing loss (15.5% to 3.3%) in those patients receiving steroids. Another study using an open, prospective, randomized design evaluated the use of dexamethasone (without placebo control) in 429 patients with bacterial meningitis, and an overall decrease in the case-fatality rate and a decrease in adult hearing loss after pneumococcal meningitis were found. Although these findings are promising, firm recommendations regarding steroid use in adult patients or for children not suffering from *H influenzae* meningitis await further prospective, controlled clinical trials.

After treatment is initiated, contact chemoprophylaxis must be considered because selected close contacts have a 200 to 1,000 times risk rate compared with the general population. Close contacts of all ages are at risk of meningococcal meningitis, whereas the vulnerability of *H influenzae* meningitis contact is limited primarily to young children. Studies of household contacts of patients with *H influenzae* infection have found a 4.0% incidence of secondary disease in children younger than 2 years, 2.0% for children aged 2 to 3, and 0.1% for children aged 4 to 5. To highlight the low risk to health professionals, the Centers for Disease Control describe contacts at risk as "intimate contacts," defining them as household members, day-care-center contacts, and anyone with direct exposure to a patient's oral secretions, such as through mouth-to-mouth resuscitation or kissing. By contrast, prophylaxis is not indicated for persons who have had casual contact at either workplace or a classroom nor for most hospital personnel. In addition, because of the influence of age on secondary *H influenzae* disease, prophylaxis is recommended only for groups who have as one of their members a child younger than 4 years. Even so, as the effectiveness of chemoprophylaxis cannot be entirely relied on, close follow-up of those at risk may be the most important intervention. Rifampin remains the drug of choice for eliminating pharyngeal carriage of both *H influenzae* and the meningococcus. Because pharyngeal colonization may persist after traditional intravenous therapy, the treated index patient must also receive rifampin therapy before hospital discharge. The current recommendations for rifampin chemoprophylaxis are, for meningococcal disease, 600 mg orally every 12 hours for 2 days for adults, or 10 mg per kg (maximum of 600 mg) orally every 12 hours for 2 days for those aged 1 month to 12 years. For *H influenzae* disease, the recommendation for adults is 600 mg orally every 24 hours for 4 days and for those aged 1 month to 12 years is 20 mg per kg (maximum 600 mg) every 24 hours for 4 days. Recent work with ciprofloxacin and ceftriaxone sodium shows promise for simple and effective meningococcal prophylaxis, but changes in the Centers for Disease Control recommendations await further clinical trials.

ERIC WEISS, MD
Woodside, California

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